Freescale Semiconductor Public Report ESA-107

Introduction: This is the final summary report for Steam ESA-107 at Freescale Semiconductor's plant in Austin, Texas that was performed March 21-23, 2006 by James A. Eggebrecht. Plant personnel that took active participation in the ESA were primarily Billy McClure and Albert Benavides, with the assistance of Tom Oliver and Larry Carpenter who were in attendance at the ESA initiation meeting. Billy McClure and Albert Benavides were at the closeout meeting. Their participation and hospitality made the ESA a rewarding undertaking.

The steam system consists of four large boilers generating medium and low-pressure steam. Active steam headers are primarily at 60 psig and 15 psig. The 60 psig steam is used for generating hot water used for HVAC heating and "clean steam" in a clean steam generator that is then used in the process. This clean steam needs to be free of impurities and chemicals, and uses water that has been purified and filtered to the "clean" level necessary in the manufacture of silicon wafers. The 15 psig steam use is fairly minimal and used in climate control (humidification) of the ambient air conditioning systems around the plant.

This plant has an active and mature steam system that is notable for some existing BestPractices. They have an active steam trap maintenance program that was re-instituted last year. Major, critical traps are surveyed regularly once per quarter, less critical ones every six months. If time allows, or if conditions warrant, then they are evaluated more often. The pipe insulation is in very good shape with probably 99% of the steam and chilled water lines having very sufficient insulation. The few areas of concern were minor in nature, and largely due to some recent maintenance work where the insulation was removed or damaged and had not yet been repaired. Many valves in the system were not insulated, and the plant intends to look further into implementation with insulation blankets specifically made for this use. Another good practice is the budget that is earmarked for energy conservation projects. The plant personnel are actively engaged in developing projects and implementing them, and they are empowered to make decisions regarding priority of the many projects that are developed. Their current list of projects for 2006 is impressive.

Objective of ESA: Perform an ESA Steam Assessment of Freescale Semiconductor's Austin Texas semiconductor manufacturing facility. Plant personnel were trained in the use of SSAT, SSST, and 3E Plus, as well as MotorMaster.

Focus of Assessment: Steam

Approach for ESA: During the first day of the ESA visit we started with the assessment team meeting where the Plant Site Lead, Billy McClure, Albert Benavides, Facilities Project Manager, Tom Oliver, Operations Group Leader, and Larry Carpenter, Maintenance Group Leader, was apprised of what would ensue for the 3 days of the ESA. This meeting lasted about 30 minutes. The plant's responses to the SSST were then reviewed. Then Billy McClure and Albert Benavides and the ESA specialist reviewed the plant's responses on the ESA Specialist Plant Intake Questions. A plant utility system tour took place to familiarize the steam specialist with the plant's steam systems, and the general condition of the plant equipment was noted by the ESA specialist, particularly regarding the insulation which was noted as an item of concern in the SSST results. Combustion analysis tests were performed on the two operating boilers, numbers 2 and 4. The day finished with the available data from the plant records entered into the SSAT program. A preliminary match to the plant operation parameters was reached and data collection for the second day was planned. Demonstrations of 3E Plus were performed to familiarize the plant personnel with the program that would be used on the second day to quantify steam line heat losses from un-insulated sections of line.

Second day data collection involved extensive study of the steam line insulation situation. Overall, the plant systems are very well insulated with 1.5 to 3 inches of calcium silicate pipe insulation and either a PVC or aluminum jacket. About 30% of the heat loss from un-insulated portions was restricted to one small system where recent maintenance work had removed or damaged the existing insulation, and had not repaired or replaced it following completion of the work. Most of the rest of the un-insulated portions were found around valves in the piping system. Additional evaluation of the boilers discovered areas where the internal refractory was

evidently damaged and that the ends of two of the four boilers needed additional insulation. Data gathered was entered into 3E Plus and then into SSAT for the evaluation of insulation improvements.

On the third day the preliminary report was reviewed with the plant contacts and their input was incorporated. A demonstration of MotorMaster was performed too. Approval of the preliminary report was obtained from the plant site leader. The ESA Summary evaluation from the plant site leader, Billy McClure and Albert Benavides was received and compiled into the summary spreadsheet. The close out meeting was held.

General Observations of Potential Opportunities:

The plant furnished information that total consumption of natural gas in calendar year 2005 was 163,607 MCF, or 168,500 MMBtu.

A near-term opportunity that was evaluated was the installation of continuous trim boiler controls that would reduce natural gas expenditures by about $67,000.

A near-term opportunity that was evaluated was the completion of an insulation upgrade to replace damaged insulation sections and insulate the un-insulated sections of the steam header system. Savings of about $20,000/year are estimated.

A near-term opportunity that was evaluated was the reduction of boiler blowdown from the current level of 5.2% to 3%. The boiler blowdown is at a conductivity of 1,450. Savings of about $12,000/year are estimated.

Management Support and Comments:

The SSAT modeling software proved to be a useful tool to create an accurate model of our steam system that closely correlated expected natural gas usage to our actual natural gas cost for 2005. We feel comfortable in predicting projected new cost or savings associated with system parameter changes resulting from changes in fuel cost, insulation upgrades or process and equipment changes/upgrades.

The SSAT software predicted projected savings from burner control upgrades that we are considering comparable with projections promised by our vendors. We can now move forward with more confidence that the project will pay back with the projected ROI. Discussion of the methods used in the SSAT software to model steam trap inspection practices also added additional justification to our re-implementation of our steam trap maintenance program that we had let lapse in the past but had re-instituted last year.

We plan to evaluate opportunities in insulating numerous valves that are currently bare metal exposed. Several areas were identified where system heat loss can be improved. We also plan to look at opportunities for utilizing waste stack heat.

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